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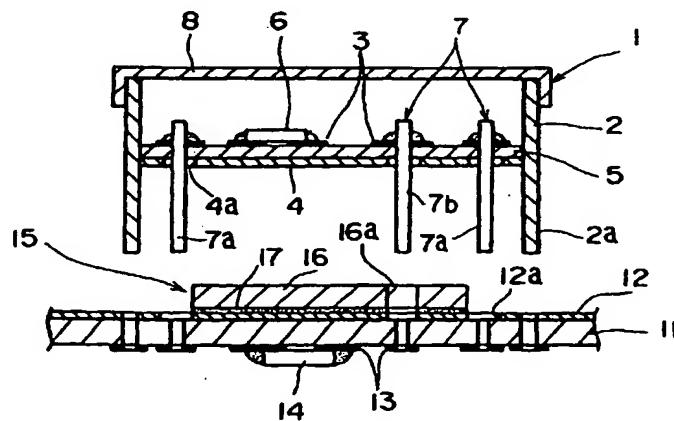
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(54) Oscillator attachment structure preventing interference by beat signal

(57) An oscillator attachment structure which prevents inference by a beat signal caused by mixture of a reference oscillation signal from a PLL circuit and an oscillation signal from an oscillator. A plate conductive rubber member (16), electrically connected to a ground conductor (12), is provided on the lower surface of a circuit board, and the conductive rubber member is placed

on a ground conductive member of a printed circuit board. The ground conductor and the ground conductive member are electrically connected to each other, and the circuit board can be sufficiently grounded to the PLL circuit on the printed circuit board.

FIG. 1



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Description**BACKGROUND OF THE INVENTION****Field of the Invention**

[0001] The present invention relates to an oscillator attachment structure used in e.g. a head end of CATV transmitter.

Description of the Related Art

[0002] A conventional oscillator attachment structure will be described with reference to Figs. 4 to 6. An oscillator 31 has a box-shaped frame body 32 of metal plates having attachment legs 32a, a circuit board 35 having a wiring pattern 33 on its upper surface and a ground conductor 34 on its approximately entire lower surface, various electric components 36 soldered to the wiring pattern 33, connection pins 37 soldered to the wiring pattern 33, projecting downward through the circuit board 35, and a metal cover 38 over the frame body 32, and the like.

[0003] Further, the connection pins 37 include plural power-source connection pins 37a provided in left and right positions, a tuning connection pin 37b, an output connection pin 37c and a ground connection pin 37d positioned between the power-source connection pins 37a. The connection pins 37 are not electrically connected to the ground conductor 34 by relief members 34a comprising rejection members provided in the ground conductor 34.

[0004] A printed circuit board 41 comprising a mother board forming a head end holds a ground conductive member 42 on its upper surface, a wiring pattern 43 on its lower surface, and various electric components 44 soldered to the wiring pattern 43, and the like.

[0005] Further, a buffer member 45 is formed with a rubber member 46 of plate insulating member and adhesive 47 provided on the lower surface of the rubber member 46. The buffer member 45 is attached to the upper surface of the ground conductive member 42 of the printed circuit board 41 by the adhesive 47.

[0006] Further, a PLL circuit (not shown) is formed in the wiring pattern 43 opposite to the buffer member 45.

[0007] In the above-described oscillator 31, the attachment legs 32a of the frame body 32 and the power-source connection pins 37a are inserted into holes of the printed circuit board 41, and the tuning connection pin 37b, the output connection pin 37c and the ground connection pin 37d are inserted through holes of the buffer member 45 and the printed circuit board 41, further, the lower surface of the circuit board 35 is placed on the rubber member 46. In this state, the connection pins 37 and the attachment legs 32a are soldered to the wiring pattern 43, thus the oscillator 31 is

mounted on the printed circuit board 41.

[0008] Further, the power-source connection pins 37a, the tuning connection pin 37b and the like are not electrically connected to the ground conductive member 42 by relief members 42a comprising rejection members provided in the ground conductive member 42.

[0009] In the oscillator attachment structure having the above construction, fluctuations of oscillation waveform from the oscillator 31 due to shock and vibration from the printed circuit board 41 side as a main body side, i.e., f skip and the like are prevented by the buffer member 45.

[0010] However, as the rubber member 46 of insulating material is used, a capacitance formed between the ground conductor 34 of the circuit board 35 and the ground conductive member 42 of the printed circuit board 41 is small, and the circuit board 35 is not sufficiently grounded to the printed circuit board 41 in a so-called electrically floating state.

[0011] As a result, a reference oscillation signal from the PLL circuit formed on the printed circuit board 41 side influences the circuit board 35 side. The signal is mixed with an oscillation signal from the oscillator constructed on the circuit board 35, which causes a beat signal as an interference signal.

[0012] In the conventional oscillator attachment structure, as the circuit board of the oscillator 31 is supported by the printed circuit board 41 via the rubber member 46 of insulating material, a capacitance formed between the ground conductor 34 of the circuit board 35 and the ground conductive member 42 of the printed circuit board 41 is small. The circuit board 35 is not sufficiently grounded to the printed circuit board 41 in a so-called electrically floating state. As a result, a reference oscillation signal from the PLL circuit formed on the printed circuit board 41 side influences the circuit board 35 side. The signal is mixed with an oscillation signal from the oscillator constructed on the circuit board 35, which causes a beat signal as an interference signal.

SUMMARY OF THE INVENTION

[0013] The present invention has been made in consideration of the above situation, and provides an oscillator attachment structure which prevents a beat signal as an interference signal and attains excellent performance.

[0014] According to one aspect of the present invention, the foregoing object is attained by providing an oscillator attachment structure comprising: an oscillator having a metal frame, and a circuit board having a ground conductor on its lower surface and being attached within the frame; and a printed circuit board having a ground conductor on its upper surface, to which the oscillator is attached, wherein when the oscillator is attached to the printed circuit board, a plate conductive rubber member, electrically connected to the ground conductor, is provided on the lower surface of

the circuit board, and the conductive rubber member is placed on the ground conductor.

[0015] Further, according to another aspect of the present invention, the foregoing object is attained by providing an oscillator attachment structure comprising: an oscillator having a metal frame, and a circuit board having a ground conductor on its lower surface and being attached within the frame; and a printed circuit board having a ground conductor on its upper surface, to which the oscillator is attached, wherein when the oscillator is attached to the printed circuit board, a plate conductive rubber member, electrically connected to the ground conductor, is provided on the lower surface of the circuit board, and the conductive rubber member is placed via a thin-plate insulating member on the ground conductor.

[0016] Preferably, the insulating member comprises a double-faced adhesive tape, and wherein the conductive rubber member and the ground conductor are attached to each other by the double-faced adhesive tape.

[0017] Advantageously, conductive grease is provided between the conductive rubber member and the ground conductor.

[0018] Other features and advantages of the present invention will be apparent from the following description taken in conjunction with the accompanying drawings, in which like reference characters designate the same name or similar parts throughout the figures thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

Fig. 1 is an exploded cross-sectional view of an oscillator attachment structure according to the present invention;

Fig. 2 is a cross-sectional view showing principal elements of the oscillator attachment structure according to the present invention;

Fig. 3 is a cross-sectional view cut along a line 3-3 in Fig. 2 showing the principal elements;

Fig. 4 is an exploded cross-sectional view of the conventional oscillator attachment structure;

Fig. 5 is a cross-sectional view showing principal elements of the conventional oscillator attachment structure; and

Fig. 6 is a cross-sectional view cut along a line 6-6 in Fig. 5 showing the principal elements.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0020] A preferred embodiment of the present invention will now be described in detail in accordance with the accompanying drawings.

[0021] An oscillator attachment structure according to the present invention will be described with reference to Figs. 1 to 3. An oscillator 1 has a box-shaped frame body 2 of metal plates having attachment legs 2a, a circuit board 5 having a wiring pattern 3 on its upper surface and a ground conductor 4 on its approximately the entire lower surface, various electric components 6 soldered to the wiring pattern 3, connection pins 7 soldered to the wiring pattern 3, projecting downward through the circuit board 5, a metal cover 8 over the frame body 2, and the like.

[0022] The connection pins 7 include plural power-source connection pins 7a provided in left and right positions, a tuning connection pin 7b, an output connection pin 7c and a ground connection pin 7d provided between the power-source connection pins 7a. The connection pins 7 are not electrically connected to the ground conductor 4 by relief members 4a of rejection members provided in the ground conductor 4.

[0023] A printed circuit board 11 comprising a mother board forming a head end holds a ground conductive member 12 on its upper surface, a wiring pattern 13 on its lower surface, and various electric components 14 soldered to the wiring pattern 13, and the like.

[0024] Further, a buffer member 15 is formed with a conductive rubber member 16 of plate conductive member and an insulating member 17, comprising a thin-sheet double-faced adhesive tape, provided on the lower surface of the conductive rubber member 16. The buffer member 15 is attached to the upper surface of the ground conductive member 12 of the printed circuit board 11 by the insulating member 17 as a double-faced adhesive tape.

[0025] Further, a PLL circuit (not shown) is formed in the wiring pattern 13 opposite to the buffer member 15.

[0026] In the above-described oscillator 1, the attachment legs 2a of the frame body 2 and the power-source connection pins 7a are inserted into holes of the printed circuit board 11, and the tuning connection pin 7b, the output connection pin 7c and the ground connection pin 7d are inserted through holes of the buffer member 15 and the printed circuit board 11. Further, the lower surface of the circuit board 5 is placed on the conductive rubber member 16, and the conductive rubber member 16 is electrically connected to the ground conductor 4. In this state, the connection pins 7 and the attachment legs 2a are soldered to the wiring pattern 13, thus the oscillator 1 is mounted on the printed circuit board 11.

[0027] Further, the power-source connection pins

7a, the tuning connection pin 7b and the like are not electrically connected to the ground conductive member 12 by relief members 12a comprising rejection members provided in the ground conductive member 12, and the tuning connection pin 7a and the output connection pin 7c are not electrically connected to the conductive rubber member 16 by relief members 16a comprising large holes provided in the conductive rubber member 16.

[0028] In the oscillator attachment structure having the above construction, fluctuations of oscillation waveform from the oscillator 1 due to shock and vibration from the printed circuit board 1 as a main body side, i.e., f skip and the like are prevented by the buffer member 15.

[0029] Further, the conductive rubber member 16 of conductive rubber material is electrically connected to the ground conductor 4, and the conductive rubber member 16 and the ground conductive member 12 are in close proximity via a thin insulating member 17. This causes a large capacitance between the ground conductor 4 of the circuit board 5 and the ground conductive member 12 of the printed circuit board 11, attaining the same potentials of alternating current and sufficiently grounds the circuit board 5 to the PLL circuit on the printed circuit board 11.

[0030] As a result, a reference oscillation signal from the PLL circuit formed on the printed circuit board 11 side does not influence the circuit board 5 side, thus no beat signal as an interference signal occurs.

[0031] Note that in the above embodiment, a double-faced adhesive tape is used as the insulating member 17, however, it may be arranged such that the insulating member 17 is omitted and the conductive rubber member 16 is directly electrically connected to the ground conductor 4 and the ground conductive member 12. In this case, as a capacitance is not caused between the ground conductor 4 and the ground conductive member 12, ground therebetween can be more reliable. Thus a high-performance oscillator can be provided.

[0032] Further, if conductive grease is provided between the ground conductor 4 and the conductive rubber member 16, the electrical connection therebetween can be more excellent.

[0033] In the oscillator attachment structure according to the present invention, the plate conductive rubber member 16, electrically connected to the ground conductor 4, is provided on the lower surface of the circuit board 5, and the conductive rubber member 16 is placed on the ground conductive member 12. As the ground conductor 4 and the ground conductive member 12 are electrically connected to each other, the printed circuit board 11 can be sufficiently grounded to the PLL circuit on the circuit board 5.

[0034] As a result, the reference oscillation signal from the PLL circuit formed on the printed circuit board 11 side does not influence the circuit board 5 side, thus

no beat signal as an interference signal occurs.

[0035] Further, the plate conductive rubber member 16, electrically connected to the ground conductor 4, is provided on the lower surface of the circuit board 5, and the conductive rubber member 16 is placed on the ground conductive member 12 via the thin-plate insulating member 17. As the conductive rubber member 16 and the ground conductive member 12 are in close proximity via the thin insulating member 17, a large capacitance is caused between the ground conductor 4 of the circuit board 5 and the ground conductive member 12 of the printed circuit board 11. This attains the same potential of alternating current, and sufficiently grounds the circuit board 5 to the PLL circuit on the printed circuit board 11.

[0036] As a result, the reference oscillation signal from the PLL circuit formed on the printed circuit board 11 side does not influence the circuit board 5 side, thus an oscillator attachment structure which prevents a beat signal as an interference signal can be provided.

[0037] Further, as the insulating member 17 is a double-faced adhesive tape, and the conductive rubber member 16 and the ground conductive member 12 are attached to each other by the double-faced adhesive tape, the attachment of the conductive rubber member 16 can be made in a simple manner. Thus a high-producibility oscillator attachment structure can be provided.

[0038] Further, as the conductive grease is provided between the conductive rubber member 16 and the ground conductor 4, the electrical connection therebetween can be more excellent.

[0039] The present invention is not limited to the above embodiment and various changes and modifications can be made within the spirit and scope of the present invention. Therefore, to appraise the public of the scope of the present invention, the following claims are made.

40 Claims

1. An oscillator attachment structure comprising: a metal frame; an oscillator provided with a circuit board having a first ground conductor on its lower surface and being attached within the frame; and a printed circuit board having a second ground conductor on its upper surface, to which the oscillator is attached,
wherein a plate conductive rubber member is made to conduct to the first ground conductor and is provided on the lower surface of the circuit board, the conductive rubber member is placed on the second ground conductor, and the oscillator is attached to the printed circuit board.
2. An oscillator attachment structure comprising: a metal frame; an oscillator provided with a circuit board having a first ground conductor on its lower

surface and being attached within the frame; and a printed circuit board having a second ground conductor on its upper surface, to which the oscillator is attached,

wherein a plate conductive rubber member is made to conduct to the first ground conductor and is provided on the lower surface of the circuit board, the conductive rubber member is place via a thin-plate insulating member on the second ground conductor, and the oscillator is attached to the printed circuit board.

3. The oscillator attachment structure according to claim 2, wherein the insulating member comprises a double-faced adhesive tape, and wherein the conductive rubber member and the second ground conductor are adhered to each other by the double-faced adhesive tape. 15
4. The oscillator attachment structure according to claim 1, wherein conductive grease is interposed between the conductive rubber member and the first ground conductor. 20
5. The oscillator attachment structure according to claim 2, wherein conductive grease is interposed between the conductive rubber member and the first ground conductor. 25
6. The oscillator attachment structure according to claim 3, wherein conductive grease is interposed between the conductive rubber member and the first conductor. 30

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FIG. 1

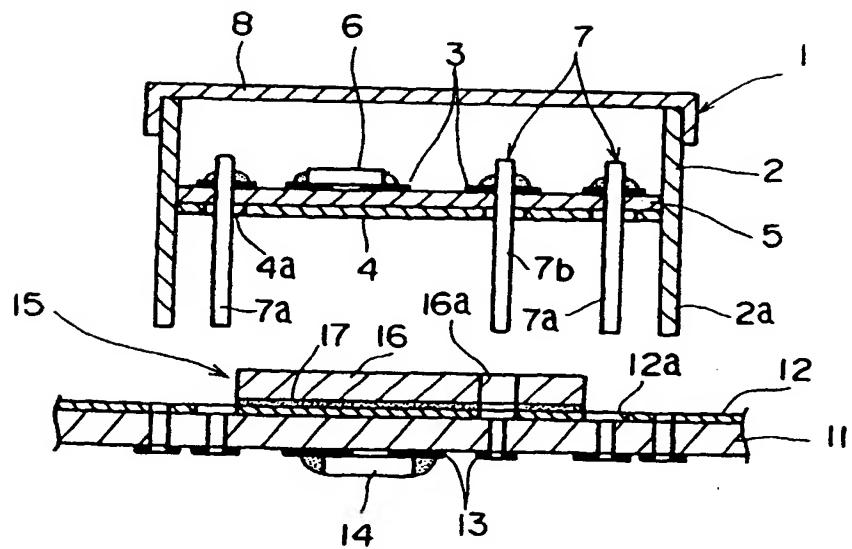


FIG. 2

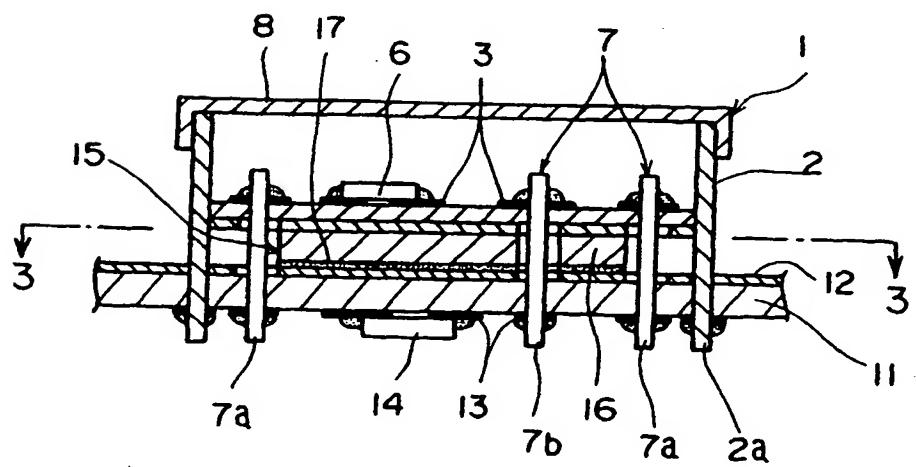


FIG. 3

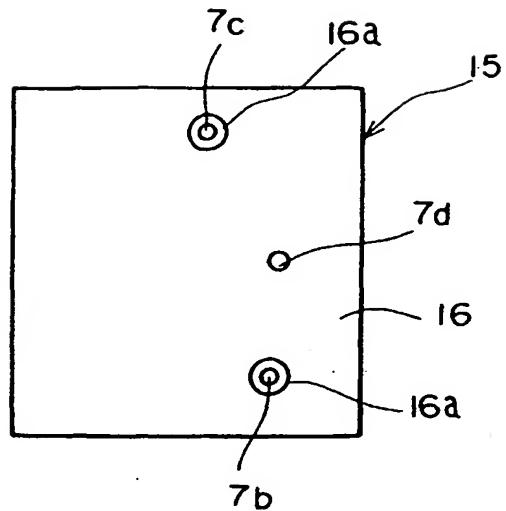
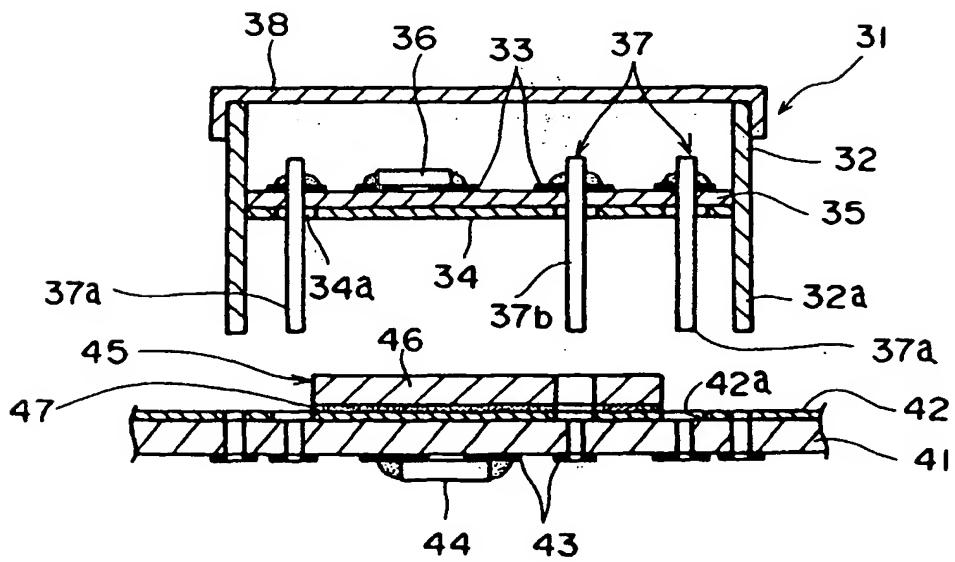
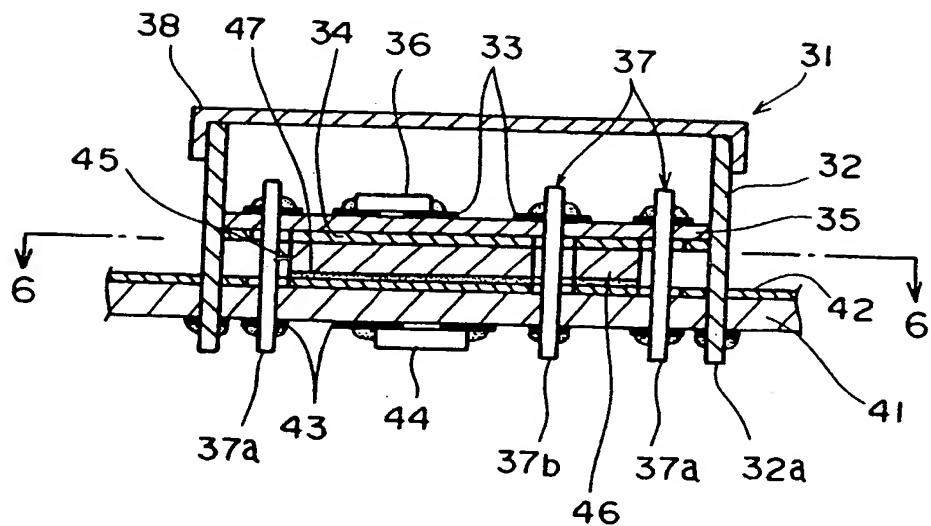


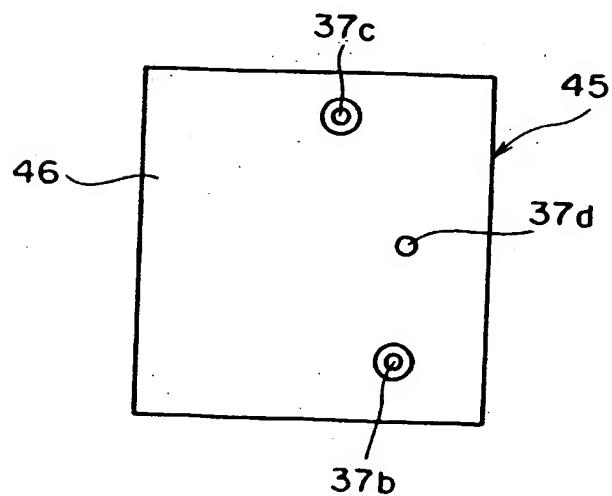
FIG. 4
PRIOR ART



*FIG. 5
PRIOR ART*



*FIG. 6
PRIOR ART*





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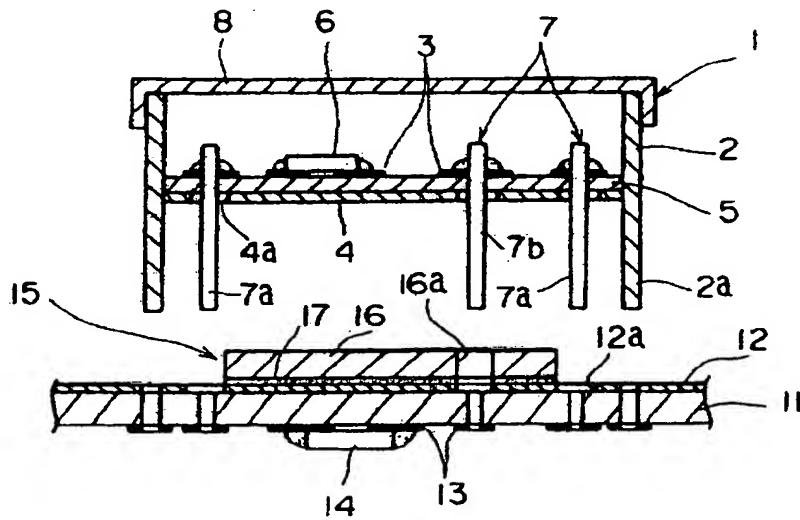
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cuit board, and the conductive rubber member is placed on a ground conductive member of a printed circuit board. The ground conductor and the ground conductive member are electrically connected to each other, and the circuit board can be sufficiently grounded to the PLL circuit on the printed circuit board.

FIG. 1





European Patent
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EUROPEAN SEARCH REPORT

Application Number

EP 00 30 8956

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)				
A	EP 0 910 163 A (MURATA MANUFACTURING CO) 21 April 1999 (1999-04-21) * column 6, line 24 - line 41 *	1,2	H03B1/02 H05K9/00				
A	US 4 034 318 A (ISHIYAMA HIDEKI ET AL) 5 July 1977 (1977-07-05) * claim 1 *	1,2					
A	PATENT ABSTRACTS OF JAPAN vol. 1998, no. 14, 31 December 1998 (1998-12-31) & JP 10 252178 A (SHIMIZU CORP), 22 September 1998 (1998-09-22)						
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<p>The present search report has been drawn up for all claims</p>							
Place of search	Date of completion of the search	Examiner					
THE HAGUE	8 March 2002	Toussaint, F					
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EP 00 30 8956

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